



## Association between serum magnesium levels with lipids profile in patients undergoing peritoneal dialysis and hemodialysis

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### Abstract

**Introduction:** Dyslipidemia, is one of the major causes of cardiovascular disease in dialysis patients.

**Objectives:** This investigation sought to assess the association of serum magnesium level and blood lipids profile in patients under peritoneal dialysis and hemodialysis.

**Patients and Methods:** This cross-sectional investigation was conducted on 110 dialysis patients. Serum lipids and magnesium levels were assessed. Data were analyzed using t-test and Pearson's correlation.

**Results:** The mean patients' age was 46.1±14.7 years. In peritoneal dialysis patients, who were not under treatment of antilipid drugs, the correlation of serum magnesium with triglyceride and VLDL was significant ( $p<0.05$ ), while the association of serum magnesium with total cholesterol and LDL-C was significant, only in subgroup who were under treatment of antilipid drugs ( $p<0.05$ ). In hemodialysis patients, the correlation of serum magnesium with total cholesterol, triglyceride and VLDL was significant ( $p<0.05$ ).

**Conclusions:** This study revealed that serum magnesium had correlation with serum lipids and could influence to atherosclerosis and cardiovascular disease in dialysis patients.

**Keywords:** Magnesium, Lipids, Peritoneal dialysis, Hemodialysis

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### Introduction

Renal replacement therapy is a general term applied for several techniques which are used in the treatment of patients with end-stage renal failure. It includes different methods such as hemodialysis, peritoneal dialysis, and renal allograft transplantation (1,2). The efficacy of peritoneal dialysis as a method of renal replacement therapy has been proven. The purpose of dialysis is to maintain the normal balance of acid and base and electrolytes in the body, remove metabolic wastes, and maintain the normal condition of body (2,3).

Magnesium is one of the elements present in the body that is necessary for most of enzyme systems. It is the second major intracellular cation and plays a major role in the energy conversion from ATP to ADP. The magnesium content of the body is about 2,000 mEq, half of which is inside bones (4-6). Less than 1% of magnesium is within the intercellular fluid. The normal level of plasma magnesium is about 1.3 to 2.2 mEq per liter, 20% of

which is attached to proteins. Magnesium concentration in red blood cells indicates the intracellular magnesium concentration. A healthy person needs 20-30 mEq magnesium daily. This amount of magnesium is absorbed through the gastrointestinal system. Increased level of magnesium is observed in patients with renal failure and hypothyroidism, and those who take antacid drugs. A reduced blood level of magnesium is also observed in malnutrition and malabsorption (4,5).

Some studies have shown that magnesium can affect the emergence and development of atherosclerosis through making changes in inflammatory processes in damages caused by cell oxidation, increasing the levels of serum LDL-C, and through stimulating growth factors. Magnesium does not directly augment the synthesis of lipoproteins; however it may affect the arrangement of enzymes responsible for the synthesis of lipoprotein in the liver. Consequently they are more effective in changing the metabolism of triglycerides (4-7).

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### ■ Implication for health policy/practice/research/medical education

In a study on 110 dialysis patients, we found that serum magnesium levels are associated with lipids profile of patients undergoing dialysis and could contribute to atherosclerosis and cardiovascular disease in these patients.

Kidneys are the main organ responsible for magnesium discharge, hence it is expected to observe the increased levels of serum magnesium in patients with renal failure (7,8).

Lipid disorders, including hypercholesterolemia, hypertriglyceridemia, and lower concentrations of HDL-C, are among of the main factors causing cardiovascular diseases in patients undergoing dialysis (9). The incidence of cardiac death in patients undergoing dialysis and kidney transplant is about 4 to 20 times higher than that in normal people (8-10). Hyperlipidemia is an important risk factor for vascular atherosclerosis in patients undergoing dialysis and is characterized by hypertriglyceridemia (7-10). Another type of dyslipidemia is characterized by reduced HDL-C and increased serum lipoprotein a, and it usually happens without increasing LDL-C (8-12). Lipoprotein (a) is a non-dependant factor for cardio vascular diseases (7-11). Studies have shown that increased level of lipoprotein is associated with death from cardiovascular disease (9-13).

Data reported in the United States show that 42.5% of patients undergoing hemodialysis, 41.7% of patients undergoing peritoneal dialysis, and 31.1% of renal transplant patients died due to heart and cerebrovascular diseases (9-14).

### Objectives

So far, several studies have been conducted on the association between serum levels of magnesium and lipid profiles in patients undergoing hemodialysis, however, no similar study has been conducted on patients undergoing peritoneal dialysis. Hence, this study was designed to compare hemodialysis with peritoneal dialysis and to use the results of analyses for designing better treatment of patients.

### Patients and Methods

This descriptive-analytical study was conducted on 110 dialysis patients admitted to Imam-Ali hospital and Khatam Al-Anbia hospital in Zahedan. Patients were divided into two groups of peritoneal dialysis (n=30) and hemodialysis (n=80). Patients taking diuretics, those affected by acute or chronic infection (chronic pyelonephritis of vessels), and people with malnutrition (BMI < 18.5 kg/m<sup>2</sup>), hypothyroidism, and chronic and acute diarrhea were excluded. First, patients undergoing hemodialysis or peritoneal dialysis, who were regularly

monitored and had passed at least three months since their dialysis, were invited to a clinic and after registration they signed a consent form to participate in the study. Then, taking into consideration a history of hyperlipidemia (being under the treatment using antilipidemic drugs), patients were classified into two subgroups; patients under antilipidemic treatments and patients not under antilipidemic treatments (classification was done for both groups of patients undergoing peritoneal dialysis and patients undergoing hemodialysis). Blood samples were taken to measure the level of magnesium and the lipid profile.

### Ethical issues

The study was approved by the institutional ethics committee of Zahedan University of Medical Sciences. A written informed consent was obtained from all the study participants.

### Statistical analysis

Data were entered into SPSS software; using statistical t-test and Pearson's correlation test. Magnesium levels and blood lipid levels were measured and analyzed. At the end, the results of each group were compared with the results of other group. P values of less than 0.05 was assumed to be significant (p<0.05).

### Results

In this study, 110 patients undergoing hemodialysis and peritoneal dialysis were divided into two groups. Of all, 51 patients (46.4%) were male and 89 patients (53.6%) were female and the mean age of patients was 46.1 ± 14.7 years. Table 1 presents the mean scores of demographic variables in the two groups which were obtained using independent t-test. In patients undergoing peritoneal dialysis, the association between magnesium and cholesterol was significant only among patients who were taking antilipid drugs (p=0.003). In peritoneal dialysis patients, the association between magnesium level and LDL-C was significant only among patients who were taking antilipid drugs (p=0.036) too. In peritoneal dialysis patients, the association between magnesium level and VLDL-C was significant among patients who were not taking antilipid drugs (p=0.001). Moreover, in the same subgroup, magnesium levels were associated with triglycerides (p<0.001). The association between serum magnesium level and cholesterol in hemodialysis patients who were not taking anti lipid drugs was also significant (p<0.001). In addition, in this group, the association between magnesium and VLDL-C in the patients who were not taking antilipid drugs was significant (p<0.001). In the same subgroup, magnesium level was associated with triglyceride levels (p<0.001).

### Discussion

In this study, a total of 110 patients were enrolled in the

**Table 1.** Mean scores of demographic variables in the two groups

Variable	Group	No.	Mean ± Standard deviation	P-value
Age	Peritoneal dialysis	30	37.2 ± 10.9	0.001
	Hemodialysis	80	49.3 ± 14.7	
Duration of dialysis	Peritoneal dialysis	30	3.2 ± 1.6	0.178
	Hemodialysis	80	3.9 ± 2.9	
Duration DM	Peritoneal dialysis	5	7.2 ± 2.6	0.003
	Hemodialysis	22	14.1 ± 8.1	

two groups of peritoneal dialysis and hemodialysis. In patients undergoing peritoneal dialysis, the association between serum magnesium and cholesterol was significant only among patients who were taking antilipid drugs. The association between magnesium level and LDL-C in peritoneal dialysis patients was significant only among patients who were taking antilipid drugs. In peritoneal dialysis patients, in patients who were not taking antilipid drugs the association between magnesium level and VLDL-C was also significant. Moreover, in the same group, magnesium levels were associated with triglycerides.

Nasri *et al.*, conducted a study in 2004 and reported the positive association between serum levels of magnesium and Lp (a) and blood triglycerides in hemodialysis patients (15). Similarly, in our study we observed a relationship between magnesium and triglycerides. However, in Nasri *et al.* study no association between magnesium and cholesterol levels was found. On the other hand, Robles *et al.* in 1998 conducted a study on 25 patients undergoing hemodialysis and they found a direct positive association between magnesium and total cholesterol and triglyceride (16). The results of Robles *et al.* study were consistent with our results with respect to findings about peritoneal dialysis patients who were taking antilipid drugs. In another study by Ansari *et al.* in 2012, the relationship between serum magnesium levels and dyslipidemia in hemodialysis patients was examined and the results showed that there was a significant relationship between increased blood magnesium levels and dyslipidemia in this group of patients. In their study, the increased levels of serum magnesium, Lp (a), triglycerides, and HDL-C did not have a direct and significant association with cholesterol levels (17). Similar to our results, their results showed that magnesium level was associated with triglycerides.

Some studies have shown that magnesium can affect the emergence and development of atherosclerosis through making changes in the inflammatory processes in damages caused by cell oxidation, increasing the levels of serum LDL-C, and through stimulating growth factors. Magnesium does not directly augment the synthesis of lipoproteins; however it may affect the arrangement of enzymes responsible for the synthesis of lipoprotein in the liver. Consequently they are more effective in changing the metabolism of triglycerides (18-22). Kidneys are the main organ responsible for magnesium discharge, hence it is expected to observe the increased

levels of serum magnesium in patients with renal failure (1-5). Lipid disorders, including hypercholesterolemia, hypertriglyceridemia, and lower concentrations of HDL-C, are among of the main factors causing cardiovascular diseases in patients undergoing dialysis (15-19). Hyperlipidemia is an important risk factor for vascular atherosclerosis in patients undergoing dialysis (17-20). Serum magnesium levels can be a contributing factor in atherosclerosis emergence and development, thus, controlling level of serum magnesium and blood lipid levels seem to be critical and effective in survival of patients (18-24).

### Conclusion

The results of this study suggest that serum magnesium levels are associated and correlated with lipid profile of patients undergoing dialysis. Moreover, disorders of lipid metabolism can increase the risk of atherosclerosis and heart disease in this group of patients.

### Authors' contributions

All authors wrote the manuscript equally.

### Conflict of interests

The authors declared no competing interests.

### Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the authors.

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